Manitoba Environmental Council Topics

1. Environmental Quality Preferences

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ANNOUNCEMENT

The Manitoba Environmental Council is a citizens advisory organization to the Manitoba Minister responsible for environmental management. It advises the Minister with regard to environmental problems and issues that impact on Manitoba or affect Manitobans.

The Council's purpose is also to issue environmental information relevant to Manitoba. Since its establishment in 1972, the Council has fulfilled this mandate by publishing both Annual Reports and Studies. It became apparent that the establishment of a third type of publication would allow additional pertinent material to be made available.

It is a pleasure, therefore, to announce the issuance of the Council's new publication series, "TOPICS". It has been designed to accommodate diverse materials providing they meet the "publishable" criteria. It will also serve as a vehicle for supportive data that previously would have been included in annual reports or remained unpublished. "TOPICS" will be issued in a typewritten format thereby eliminating typesetting costs and expediting publication. It will be distributed in the same manner as other Council publications.

This additional publication series makes it even more evident that the Manitoba Environmental Council is playing a significant role in the education of Manitobans in the area of our priceless environment.

BILL KENNEDY,
Chairman.

MEASURING ENVIRONMENTAL QUALITY PREFERENCES THROUGH A PERSONAL-COST QUESTIONNAIRE

by

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SUMMARY

An Environmental Quality Questionnaire was developed to measure personal preference about environmental quality. The measurement or rating system was based upon an individual's willingness to pay from his or her own pocket specific dollar amounts to achieve specific environmental qualities.

Ninety-nine environmental qualities were rated by 50 members of the Manitoba Environmental Council. Ratings were analysed in terms of:

1. which qualities are most and least preferred,
2. which factors best summarize (or explain) the ratings, and
3. which items can best be used on a shortened version of the Questionnaire.

Results indicated that the 12 most preferred (desirable) environmental qualities (out of the 99 rated) were:

1. more research on new and desirable sources of energy;
2. better protection of water quality from sewage, chemicals, radioactivity and other pollutants;
3. enforcement of environmental quality standards;
4. cleaner water in rivers and lakes;
5. more research on ecology;
6. more restrictions on "off-the-road" vehicles (snowmobiles, dirt bikes, etc.);
7. establishment of environmental quality standards;
8. more compatible relationships between wildlife and human beings;
9. non-pollution of land;
10. greater protection for endangered species;
11. more detailed regulation of land-use; and
12. better city transit.

Apparently, the most favorable "areas of concern" are establishing and enforcing environmental quality standards, performing research on ecology and new energy sources, maintaining clean water and land, increasing wildlife protection and compatability with humans, and improving city transit. Raters seemingly place a high value on knowing about the natural environment and taking steps to preserve it. Raters also exhibit a practical reaction within cities for better public transportation.

Results also indicated that the 12 least preferred (desirable) environmental qualities (out of the 99 rated) were:

99. snowmobiles in towns,
98. more areas for motor boating,
97. more areas for snowmobiling,
96. more areas for hunting animals,
95. more areas for hunting birds,
94. more areas for waterskiing,
93. more areas for trapping,
92. settlement of Crown Lands,
91. horseback riding paths in towns,
90. more restrictive downtown parking,
89. greater industrial use of water, and
88. more commercial and industrial land.

Apparently, the least favorable "areas of concern" are recreation which might disturb the environment, elimination of land and wildlife for sport or profit, and restriction of downtown parking. Raters seemingly place a low value on potential misuse and exhaustion of the natural environment. Raters also exhibit a practical reaction within cities against restrictive downtown parking.

After the completion of the preference analysis, the questionnaire ratings were factor analysed to determine the smallest number of factors which could account for most of the variation in ratings across the 99 items. Eight factors accounted for over 80% of the variation. The most general factor was so comprehensive that all but four of the 99 items contributed significantly to it. Inspection of the items contributing significantly to the remaining seven factors suggests that ratings can be best summarized (or explained) on the basis of:

1. concern for the natural environment,
2. management and use of the natural environment,
3. non-commercial use of the natural environment,
4. non-involvement in the wilderness but practical use of the city,
5. preservation of the wilderness and town areas,
6. commercial use of the land,
7. non-romanticizing of nature, and
8. access to wilderness areas.

A major purpose of the present project was to develop an environmental questionnaire which could easily be completed in a short period of time. The 99 item questionnaire was considered too lengthy and time-consuming for many uses. The method employed for constructing a brief version of the Environmental Quality Questionnaire was to include all items among the top 7 contributors to at least one of the eight factors (see Tables 4 and 5). Only those items correlating above .361 with a factor were eligible for inclusion. Four factors (5, 6, 7 and 8) had less than 7 contributing items. At the end of this stage 40 items had been retained.

The Brief Environmental Quality Questionnaire consisted of the 40 retained items, which represented a 60% reduction in items. This instrument was recommended for use on a trial basis.

In general it may be concluded that the 99 item Environmental Quality Questionnaire, based on a personal-cost approach to measurement, appears to include sufficient breadth and specificity to be useful in assessing public preferences on environmental quality. Although it may be too lengthy and time-consuming for some purposes, the brief version overcomes this problem and may prove its worth in future research on environmental quality.

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INTRODUCTION

Environmental quality is an essential part of the concept of quality of life (Nickels, Harvey, and Ledger, 1976). Attempts to define and facilitate environmental quality have tended to focus on environmental indicators (Thomas, 1972; Tunstall, 1979) and environmental indices (Inhaber, 1974, 1976). However, one can approach environmental quality by examining the preferences of the public for specific forms of environmental quality, so indicators and indices can more accurately reflect public concerns.

Recent research clearly indicates that the public is concerned about environmental quality, even at the expense of worthwhile commercial activities (Council on Environmental Quality, 1980). Therefore, the sensitive public may be in an advantageous position to act as evaluators of the relative benefits inherent in different environmental qualities. Although the public could be asked to indicate their personal preferences for different environmental qualities by rating them on a scale extending from desirable to undesirable, a more promising approach may be for the public to rate environmental qualities on the basis of their willingness-to-pay specific dollar amounts in order to obtain them (Loose, 1977, pp. 34-36). This approach would also be more promising than the approach which analyses how much people would have to be paid, as a bribe, to give up specific environmental qualities (Loose, 1977, pp. 34- 36).

This report summarizes a study designed to examine public preferences for a wide variety of environmental qualities through the use of dollar amounts raters would be willing to spend out of their annual income to help realize these qualities. In a sense, then, the present research has tried to test the feasibility of using such a personal-cost instrument at the same time as it has tried to assess public preferences for various environmental qualities.

METHOD

SUBJECTS

As an initial effort to obtain environmental quality ratings through a personal-cost questionnaire, the author sought subjects who were united in their concerns over a wide spectrum of environmental issues even though they might harbor opposing opinions on these issues. The subjects in the present study consisted of the membership of the Manitoba Environmental Council, a citizens' advisory group to the Minister responsible for environmental

management, Province of Manitoba, Canada. Membership numbers approximately 80 and includes individuals and representatives of community and national organizations, all of whom volunteer their efforts because of their concern for the Manitoba environment.

PROCEDURE

Preliminary Questionnaire. A preliminary Environmental Quality Questionnaire was constructed to provide a list of environmental qualities important enough to the public to be used as separate items on the final Questionnaire. Subjects were mailed the preliminary Questionnaire containing the following instructions:

> What a person can do is greatly influenced by what environment the person has. For each category on the next page please list at least 5 opportunities you MOST WANT from your regional environment, regardless of their present availability . . . . In constructing your list please consider opportunities in such areas as health and safety, education and appreciation, business and work, leisure and recreation.

Space was provided under each category heading for write-in responses. The headings were:

1. land (soil and rocks);
2. vegetation (trees, shrubs and wildflowers);
3. animals, fish, and birds; and
4. air and water.

By subsuming responses under specific headings, it was hoped that a wider variety of responses would be obtained. Subjects were also asked to rank in "importance to you" all items they had given (disregarding which category each fell under), so personal relevance could be evaluated. A review of the development of the preliminary Questionnaire was given by Humphries and Nickels (1980).

Final Questionnaire. Responses made to the preliminary Questionnaire formed the basis for selecting items used in the final one. Three members of the Environmental Quality Task Force analysed the 31 questionnaires returned from the 75 mailed to subjects (41% return rate). Analysis yielded the following results:

91	(34 different) responses given to land;
155	(29 different) responses given to vegetation;
84	(26 different) responses given to animals, fish, and birds;
138	(31 different) responses given to air and water; and
28	(19 different) responses unclassifiable into one of the previous four categories.

The final 99 items used in the Environmental Quality Questionnaire

(see Appendix A) were selected on the basis of the "importance" rankings associated with the 139 distinctive responses abstracted from the 496 total responses given by subjects to the preliminary Questionnaire. The resulting Environmental Quality Questionnaire was mailed to 78 subjects, 47 of whom filled it out and sent it back (60% return rate). An additional 3 Questionnaires were completed by advisers to the Council and its Executive Secretary. Since all of these Questionnaires were included in the analysis of results, the total number of subjects in the study was 50.

RESULTS AND DISCUSSION

Ratings of the 99-item Environmental Quality Questionnaire were analysed in terms of:

1. which qualities are most and least preferred,
2. which factors best summarize (or explain) the ratings, and
3. which items can best be used on a shortened version of the Questionnaire.

ENVIRONMENTAL QUALITY PREFERENCES

The 12 most and least desirable environmental qualities are summarized in Tables 1 and 2, respectively. The "most desirable" items were those with the highest number of top category ($25) ratings, while the "least desirable" items were those with the highest number of bottom category ($.00) ratings. The mean indicates the average monetary amount raters were willing to spend on a particular environmental quality (item), and the standard deviation (SD) shows the extent to which the ratings for a particular quality spread away from the mean. The total number of ratings was 4,926 (50 subjects multiplied by 99 items minus 24 ratings omitted by 6 subjects). No item had more than one missing rating.

Results indicated that the 12 <u>most</u> preferred (desirable) environmental qualities (out of the 99 rated) were:

1. more research on new and desirable sources of energy;
2. better protection of water quality from sewage, chemicals, radioactivity and other pollutants;
3. enforcement of environmental quality standards;
4. cleaner water in rivers and lakes;
5. more research on ecology;
6. more restrictions on "off-the-road" vehicles (snowmobiles, dirt bikes, etc.);
7. establishment of environmental quality standards;
8. more compatible relationships between wildlife and human beings;
9. non-pollution of land;
10. greater protection for endangered species;
11. more detailed regulation of land-use; and
12. better city transit.

Apparently, the most favorable "areas of concern" are establishing and enforcing environmental quality standards, performing research on ecology and new energy sources, maintaining clean water and land, increasing wildlife protection and compatibility with humans, and improving city transit. Raters seemingly place a high value on knowing about the natural environment and taking steps to preserve it. Raters also exhibit a practical reaction within cities for better public transportation.

Results also indicated that the 12 least preferred (desirable) environmental qualities (out of 99 rated) were:

99. snowmobiles in towns,
98. more areas for motor boating,
97. more areas for snowmobiling,
96. more areas for hunting animals,
95. more areas for hunting birds,
94. more areas for waterskiing,
93. more areas for trapping,
92. settlement of Crown Lands,
91. horseback riding paths in towns,
90. more restrictive downtown parking,
89. greater industrial use of water, and
88. more commercial and industrial land.

Apparently, the least favorable "areas of concern" are recreation which might disturb the environment, elimination of land and wildlife for sport or profit, and restriction of downtown parking. Raters seemingly place a low value on the potential misuse and exhaustion of the natural environment. Raters also exhibit a practical reaction within cities against restrictive downtown parking.

Since there is a wide yet meaningful variation in preferences for the 99 environmental qualities (with several qualities forming a rather coherent value-cluster), the results support the feasibility of using the personal-cost approach in the assessment of environmental quality preferences. Although the objective format of "cost-benefit" and "cost-effectiveness" approaches may have merit (Rigaux and Singh, 1977; Wolfe, 1973), the subjective format of the "willingness-to-pay" approach used here also seems to be feasible according to present results. This approach may be useful either alone or in combination with more "objective" assessment methods.

ENVIRONMENTAL QUALITY FACTORS

Ratings were factor analysed to determine the smallest number of factors which could account for the variation in ratings across the 99 items. Through such information a better understanding of the pattern and structure of environmental quality preferences is possible. Items tending to

cluster together can be viewed as contributing similarly to people's ratings of environmental quality.

The 99 items were factor analysed into their principal components.

> . . . factor analytic techniques enable us to see whether some underlying pattern of relationships exist such that the data may be 'rearranged' or 'reduced' to a smaller set of factors or components that may be taken as source variables accounting for the observed inter-relationships in the data (Kim, 1975, p. 469).

Eight principal components or clusters of items were retained, accounting for over 80% of the variation (variance) in responses to the Questionnaire. The eigenvalue, percentage of variance accounted for by each factor, and cumulative percentage of variance accounted for by each factor are presented in Table 3. (See Appendix B for a detailed summary of statistical information.)

One of the best ways to appreciate what the eight factors represent is to observe which items contribute to which factors and how strong each contribution is. Table 4 gives the factor loadings. This is the correlation of each item with each factor. A correlation must be at least .361 (regardless of sign) to be included. Factors explain rating variability; they do not indicate whether environmental qualities are preferred or not.

Factor 1. This factor appears to measure "concern for the natural environment." All items except 35, 43, 68 and 91 contribute substantially to this factor, and all contributions are in a positive direction. (See Table 5 for more detailed information on specific items contributing to Factor 1.) Such a finding suggests that almost all items of the Environmental Quality Questionnaire tap something in common, namely, respondents' sensitivity to environmental issues, regardless of their specific viewpoint about a specific environmental quality.

Factor 2. This factor appears to measure "management and use of the natural environment." Twenty-nine items contribute substantially to this factor (six loading negatively). The positive correlations indicate that responses clustering together on this factor favor people being able to make money on the benefits of nature provided they replenish nature through planned intervention. Industrialization, commercialization, and recreation are basic to factor 2, including:

1. the increased use of water, minerals, forests, and crop and grazing lands;
2. the improvement of roads and access to river and lakeshores;
3. increased irrigation and weed control;

4. the raising of animals, birds, and fish for return to the wilderness; and
5. the expansion of waterskiing, motorboating, and snowmobiling.

The negative correlations indicate that responses clustering together on this factor disfavor impediments to the use-of-nature theme (items 48 and 49) as well as luxurious developments in towns (items 84, 90, 92, and 93), which might merely impede commercialization.

Factor 3. This factor appears to measure "non-commercial use of the natural environment." Eleven items contribute substantially to this factor (one loading negatively). The positive correlations indicate that responses clustering together on this factor favor people being able to enjoy the benefits of nature, such as:

1. increasing the shade, beautification, and bicycle paths in towns;
2. expanding areas for picnicking, sailing, snowskiing, fishing, and hunting; and
3. establishing environmental quality standards so these benefits can be maintained.

The only negative correlation (item 61) indicates that responses clustering together on this factor disfavor a decreased use of chemical fertilizers, since fertilizers seem to promote the entire beautification-enjoyment process.

Factor 4. This factor appears to measure "non-involvement in the wilderness but practical use of the city." Thirteen items contribute substantially to this factor (seven loading negatively). The positive correlations indicate that the responses clustering together on this factor favor:

1. fewer hunting and fishing areas, and
2. more horseback riding paths in towns (along with more waterskiing areas).

The negative correlations indicate that responses clustering together on this factor disfavor:

1. an increase in hunting areas,
2. the establishment and enforcement of environmental quality standards,
3. research on ecology and new energy forms,
4. public education on ecology, and
5. public access to river and lakeshores.

The values reflected by this factor may represent a sort of "leave-nature-alone but improve the city" philosophy.

Factor 5. This factor appears to measure "preservation of wilderness and town areas." Six items contribute substantially to this factor (four loading negatively). The positive correlations indicate that responses clustering together on this factor favor:

1. the preservation and restoration of historical landmarks, and
2. continued access to wilderness areas.

The negative correlations indicate that responses clustering together on this factor disfavor:

1. an expansion of areas for hunting animals and birds,
2. a decreased use of chemical fertilizers, and
3. a separation of housing and industrial areas.

The values reflected by this factor seem to be protection of the status quo.

Factor 6. This factor appears to measure "commercial use of land." Six items contribute substantially to this factor (three loading negatively). The positive correlations indicate that responses clustering together on this factor favor:

1. an expansion in commercial and industrial lands, and
2. an increase in no-trapping and no-snowmobiling areas.

The negative correlations indicate that responses clustering together on this factor disfavor:

1. an expanded variety of fish and animals, and
2. cleaner and better tasting drinking water.

This factor seems to emphasize the view that land should be left undeveloped and unused until commercialization is possible, for otherwise special interest groups might oppose the development.

Factor 7. This factor appears to measure "non-romanticizing of nature." Two items contribute subtantially to this factor (both loading negatively). The negative correlations indicate that responses clustering together on this factor disfavor nature painting and raising birds for return to the wild. This factor seems to represent a negation of interest in and replenishment of our natural surroundings.

Factor 8. This factor appears to measure "access to wilderness areas." One item contributes substantially to this factor. The positive correlation indicates that responses clustering together on this factor favor access to undeveloped and untouched areas.

BRIEF ENVIRONMENTAL QUALITY QUESTIONNAIRE

As it now stands, the Environmental Quality Questionnaire appears to include sufficient breadth and specificity to be useful in assessing public preferences on environmental quality. Therefore, it may provide a method by which private organizations and governments can find out which environmental qualities are so valuable that people will spend some portion of their personal income to increase or maintain the current level of each quality. In fact, one may use the personal-cost-one-is-willing-to-pay as a measure of the "importance" a rater finds in that quality.

On the other hand, the Questionnaire, because of its breadth, may be too lengthy and time-consuming for certain purposes. However, to shorten the Questionnaire through an arbitrary elimination of items might present some difficulties. The results of the factor analysis suggest that the primary factor of the Questionnaire is an "environmental concern" factor. Therefore, any modification of the instrument would do well to retain a wide variety of item-content allowing this factor to manifest itself across the entire range of environmental issues and public opinions regarding these issues. A brief version of the Questionnaire would measure environmental quality best if it tapped widely differing views on widely differing environmental issues. The results of the factor analysis provides a basis for reducing the 99-items to a more workable number without sacrificing the breadth of the original Questionnaire.

The method employed for constructing a brief version of the Environmental Quality Questionnaire was to include all items among the top 7 contributors to at least one of the eight factors (see Tables 4 and 5). Only those items correlating above .361 with a factor were eligible for inclusion. Four factors (5, 6, 7, and 8) had less than 7 contributing items. At the end of this stage 40 items had been retained.

The Brief Environmental Quality Questionnaire consists of the following 40 items: 1, 2, 6, 8, 12, 13, 26, 27, 32, 33, 34, 41, 42, 43, 47, 48, 50, 51, 52, 61, 64, 65, 66, 67, 68, 70, 73, 77, 80, 81, 82, 83, 85, 86, 87, 88, 89, 90, 96, and 97. This Questionnaire represents a 60% reduction in number of items.

With the same format as the original Questionnaire, the Brief Questionnaire will fit on four pages rather than seven. The Brief Questionnaire has the breadth of the original Questionnaire precisely because it contains items contributing significantly to each of the eight primary factors underlying the original instrument. It is recommended that this Brief Questionnaire be given a trial administration to assess its usefulness in measuring public preferences on environmental quality.

CONCLUSION

The Environmental Quality Questionnaire, based on a personal-cost approach to measurement, appears to be a useful instrument for assessing public preferences. Future work, however, can proceed either by using it "as is" to obtain environmental quality preferences or by using the brief version so it will be more appropriate for situations where time and respondent-

motivation are seriously restricted. In either case, the results hopefully will increase our understanding of public sensitivity to the environment and to the various benefits it provides.

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Table 1. Twelve most desirable environmental qualities

Questionnaire item number	Willingness to provide. . . .	$25 ratings Number	%	All ratings Mean	SD
6	for more research on new and desirable sources of energy	18	36	10.20	11.34
18	for better protection of water quality from sewage, chemicals, radioactivity and other pollutants	17	34	10.10	10.96
2	for the enforcement of environmental quality standards	14	28	8.80	10.38
17	for cleaner water in rivers and lakes	10	20	6.62	9.48
5	for more research on ecology	9	18	6.05	9.18
15	more restrictions on "off-the-road" vehicles (snowmobiles, dirt bikes, etc.)	9	18	5.60	9.44
1	for the establishment of environmental quality standards	8	16	6.02	8.63
53	for more compatible relationships between wildlife and human beings	8	16	5.21	8.92
58	for non-pollution of the land	8	16	4.98	8.98
29	greater protection for endangered species	7	14	4.95	8.38
69	for a more detailed regulation of land-use	7	14	4.99	8.38
87	better city transit	7	14	4.94	8.50

Note: Results are based on the ratings of 50 subjects (except for items 15 and 87 which were rated by only 49 subjects).

Table 2. Twelve least desirable environmental qualities

Questionnaire item number	Willingness to provide. . . .	$.00 ratings Number	%	All ratings Mean	SD
91	snowmobile paths in towns	41	82	0.02	0.14
40	more areas for motorboating	38	76	0.13	0.71
35	more areas for snowmobiling	35	70	0.05	0.20
43	more areas for hunting animals	33	66	0.56	3.53
42	more areas for hunting birds	30	60	0.66	3.59
37	more areas for water skiing	28	56	0.28	1.00
44	more areas for trapping	28	56	0.16	0.72
75	for the settlement of Crown Lands	27	54	0.11	0.28
89	horsebackriding paths in towns	24	48	0.37	1.21
92	more restrictive downtown parking	24	48	1.51	5.03
67	for greater industrial use of water	23	46	0.53	1.37
73	more commercial and industrial land	23	46	0.20	0.74

Note: Results are based on the ratings of 50 subjects.

Table 3. Percentage of variance accounted for by each of the eight basic factors

Factor	Eigenvalue	% of Variance	Cumulative % of Variance
1	35.87	42.5	42.5
2	9.47	11.2	53.7
3	5.35	6.3	60.0
4	5.00	5.9	65.9
5	3.34	4.0	69.9
6	3.26	3.9	73.8
7	3.17	3.8	77.6
8	2.61	3.1	80.7
Variance unaccounted for		19.3	100.0

Table 4. Questionnaire items contributing to each of the eight basic fact

Factor	Item	Correlation
1	[See Table 5]	
2	67	.695
	65	.664
	68	.642
	66	.624
	13	.603
	73[a]	.595
	64	.567
	62	.560
	59	.521
	37[a]	.511
	56	.481
	30	.480
	75	.459
	76	.450
	31	.439
	84	-.426
	92	-.423
	32[a]	.423
	28	.417
	40	.409
	49	-.409
	26[a]	.390
	48[a]	-.388
	14[a]	.387
	57	.383
	90[a]	-.381
	27[a]	.379
	93	-.366
	35	.365
3	34	.609
	97	.529
	33	.484
	61[a]	-.475
	41	.458
	96	.453
	90[a]	.416
	43[a]	.390
	39	.386
	42[a]	.382
	36	.370
4	89	.614
	51	.570
	50	.484
	2	-.471
	1	-.432
	87	.452
	6	-.419
	43[a]	-.414
	88	.397
	14[a]	-.386
	37[a]	.381
	5	-.381
	3	-.365
5	61[a]	-.402
	43[a]	-.399
	42[a]	-.393
	8	.370
	77	-.366
	12[a]	.363
6	73[a]	.432
	26[a]	-.413
	27[a]	-.403
	52	.394
	48[a]	.369
	86	-.369
7	32[a]	-.485
	47	-.474
8	12[a]	.459

Note: Items with positive correlations contribute directly to the factor, whereas those with negative correlations contribute inversely to the factor.

[a]This item contributes more than once to Factors 2 through 8.

Table 5. Questionnaire items contributing specifically to Factor 1

Item	Correlation	Item	Correlation	Item	Correlation
83	.807	86	.650	8	.545
81	.805	22	.649	19	.541
85	.783	34	.648	90	.539
80	.782	24	.647	96	.532
82	.759	48	.644	50	.526
88	.750	74	.644	61	.524
70	.741	3	.641	78	.524
39	.739	4	.640	97	.517
23	.737	11	.635	66	.514
36	.734	27	.633	65	.513
94	.733	5	.628	73	.506
10	.729	64	.627	32	.505
54	.727	26	.625	57	.496
95	.727	6	.619	37	.495
79	.726	72	.617	12	.489
9	.724	93	.615	42	.476
58	.723	38	.614	87	.466
18	.714	41	.614	2	.458
55	.714	25	.612	76	.442
20	.709	33	.611	1	.433
60	.703	31	.609	44	.433
71	.700	29	.595	92	.432
21	.699	45	.591	30	.417
84	.692	16	.586	51	.412
53	.689	98	.584	52	.410
46	.688	99	.584	40	.407
7	.679	15	.583	14	.389
59	.676	77	.580	75	.387
28	.673	69	.566	67	.384
17	.671	56	.556	89	.371
47	.670	49	.555	13	.363
63	.667	62	.550		

Note: Each item has a positive correlation associated with it, so each contributes directly to Factor 1.

APPENDIX A

date _____ name (print) _____

ENVIRONMENTAL QUALITY QUESTIONNAIRE

The Manitoba Environmental Council is trying to find out HOW IMPORTANT (in terms of dollars and cents) various environmental qualities are to the residents of Manitoba. We would appreciate your completing this questionnaire so we can obtain a better understanding of the concerns Manitobans have about the quality of their environment.

Please indicate how much you would be willing to spend out of your annual family income to help realize each environmental quality listed on the left. Indicate your answer by marking an "X" over the amount of money you would be MOST willing to spend. (Note: You are NOT making a financial commitment by answering this questionnaire. We are using monetary amounts merely as an indication of the IMPORTANCE of environmental quality.) Please answer EVERY question.

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME						
	$.00	$.01	$.05	$.25	$1	$5	$25+
01. To provide for the establishment of environmental quality standards.....							
02. To provide for the enforcement of environmental quality standards.....							
03. To provide for greater education of the public about ecology.....							
04. To provide greater emphasis on ecology in the schools.....							
05. To provide for more research on ecology.....							
06. To provide for more research on new and desirable sources of energy.....							
07. To provide more archeological and geological studies.....							
08. To provide for the preservation and restoration of historical sites and buildings.....							
09. To provide greater scenic beauty in the countryside.....							
10. To provide more wildlife habitat.....							

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME						
11. To provide for the expansion of wilderness areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
12. To provide better access to wilderness areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
13. To provide better roads.....	$.00	$.01	$.05	$.25	$1	$5	$25+
14. To provide for greater access to river and lake shores.....	$.00	$.01	$.05	$.25	$1	$5	$25+
15. To provide more restrictions on "off-the-road" vehicles (snowmobiles, dirt bikes, etc.).....	$.00	$.01	$.05	$.25	$1	$5	$25+
16. To provide for better river transportation.....	$.00	$.01	$.05	$.25	$1	$5	$25+
17. To provide for cleaner water in rivers and lakes.....	$.00	$.01	$.05	$.25	$1	$5	$25+
18. To provide for better protection of water quality from sewage, chemicals, radioactivity and other pollutants....	$.00	$.01	$.05	$.25	$1	$5	$25+
19. To provide for better flood protection and compensation.....	$.00	$.01	$.05	$.25	$1	$5	$25+
20. To provide for the use of wild foods and natural drugs.....	$.00	$.01	$.05	$.25	$1	$5	$25+
21. To provide for greater diversity in vegetation in the countryside.....	$.00	$.01	$.05	$.25	$1	$5	$25+
22. To provide for more windbreaks.....	$.00	$.01	$.05	$.25	$1	$5	$25+
23. To provide for more vegetation along riverbanks.....	$.00	$.01	$.05	$.25	$1	$5	$25+
24. To provide for less use of chemicals for killing weeds and insects.....	$.00	$.01	$.05	$.25	$1	$5	$25+
25. To provide biological rather than chemical control of weeds and insects.....	$.00	$.01	$.05	$.25	$1	$5	$25+

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME						
26. To provide a greater variety of fish	$.00	$.01	$.05	$.25	$1	$5	$25+
27. To provide a greater variety of animals	$.00	$.01	$.05	$.25	$1	$5	$25+
28. To provide a greater variety of birds	$.00	$.01	$.05	$.25	$1	$5	$25+
29. To provide greater protection for endangered species	$.00	$.01	$.05	$.25	$1	$5	$25+
30. To provide more fish to be raised for return to the lakes and streams	$.00	$.01	$.05	$.25	$1	$5	$25+
31. To provide more animals to be raised for return to the wilderness	$.00	$.01	$.05	$.25	$1	$5	$25+
32. To provide more birds to be raised for return to the wilderness	$.00	$.01	$.05	$.25	$1	$5	$25+
33. To provide more areas for picnicking	$.00	$.01	$.05	$.25	$1	$5	$25+
34. To provide more areas for swimming	$.00	$.01	$.05	$.25	$1	$5	$25+
35. To provide more areas for snowmobiling	$.00	$.01	$.05	$.25	$1	$5	$25+
36. To provide more areas for snow skiing	$.00	$.01	$.05	$.25	$1	$5	$25+
37. To provide more areas for water skiing	$.00	$.01	$.05	$.25	$1	$5	$25+
38. To provide more areas for white water canoeing	$.00	$.01	$.05	$.25	$1	$5	$25+
39. To provide more areas for sailing	$.00	$.01	$.05	$.25	$1	$5	$25+
40. To provide more areas for motorboating	$.00	$.01	$.05	$.25	$1	$5	$25+

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME						
41. To provide more areas for fishing.....	$.00	$.01	$.05	$.25	$1	$5	$25+
42. To provide more areas for hunting birds.....	$.00	$.01	$.05	$.25	$1	$5	$25+
43. To provide more areas for hunting animals.....	$.00	$.01	$.05	$.25	$1	$5	$25+
44. To provide more areas for trapping.....	$.00	$.01	$.05	$.25	$1	$5	$25+
45. To provide more areas for hiking.....	$.00	$.01	$.05	$.25	$1	$5	$25+
46. To provide more opportunities for nature photography.....	$.00	$.01	$.05	$.25	$1	$5	$25+
47. To provide more opportunities for nature painting.....	$.00	$.01	$.05	$.25	$1	$5	$25+
48. To provide a greater number of "no snowmobiling" areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
49. To provide a greater number of "no motorboating" areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
50. To provide a greater number of "no fishing" areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
51. To provide a greater number of "no hunting" areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
52. To provide a greater number of "no trapping" areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
53. To provide for more compatible relationships between wildlife and human beings.....	$.00	$.01	$.05	$.25	$1	$5	$25+
54. To provide for greater use of locally produced foods.....	$.00	$.01	$.05	$.25	$1	$5	$25+
55. To provide for the use and display of plants native to the area.....	$.00	$.01	$.05	$.25	$1	$5	$25+

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME
56. To provide for better weed control	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
57. To provide for more appropriate drainage of the land	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
58. To provide for non-pollution of the land	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
59. To provide for better irrigation of the land	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
60. To provide for erosion control	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
61. To provide for a decreased use of chemical fertilizers	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
62. To provide for an expansion of grazing and forage lands	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
63. To provide for an expansion of fruit growing areas	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
64. To provide for an expansion of lands for growing other crops	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
65. To provide for greater industrial use of mineral deposits	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
66. To provide for greater industrial use of forests	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
67. To provide for greater industrial use of water	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
68. To provide for greater use of resources of the North	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
69. To provide for a more detailed regulation of land-use	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+
70. To provide more sanitary conditions for domestic animals, birds and fish	$.00 | $.01 | $.05 | $.25 | $1 | $5 | $25+

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME						
71. To provide for increased garbage recycling.....	$.00	$.01	$.05	$.25	$1	$5	$25+
72. To provide more land for urban housing.....	$.00	$.01	$.05	$.25	$1	$5	$25+
73. To provide more commercial and industrial land.....	$.00	$.01	$.05	$.25	$1	$5	$25+
74. To provide for the development of downtown areas for living and working.....	$.00	$.01	$.05	$.25	$1	$5	$25+
75 To provide for the settlement of Crown Lands.....	$.00	$.01	$.05	$.25	$1	$5	$25+
76. To provide minimum lot sizes for urban and suburban buildings.....	$.00	$.01	$.05	$.25	$1	$5	$25+
77. To provide for the separation of housing and industrial areas.....	$.00	$.01	$.05	$.25	$1	$5	$25+
78. To provide for less crowding in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
79. To provide better garbage and sewage disposal.....	$.00	$.01	$.05	$.25	$1	$5	$25+
80. To provide ways to reduce noise in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
81 To provide greater airport noise control and safety regulations.....	$.00	$.01	$.05	$.25	$1	$5	$25+
82. To provide for better regulation of airspace.....	$.00	$.01	$.05	$.25	$1	$5	$25+
83. To provide cleaner air in buildings.....	$.00	$.01	$.05	$.25	$1	$5	$25+
84. To provide cleaner outdoor air in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
85. To provide better smelling air.....	$.00	$.01	$.05	$.25	$1	$5	$25+

IN ORDER TO HELP INCREASE THIS QUALITY OF THE ENVIRONMENT	I WOULD BE WILLING TO SPEND OUT OF MY ANNUAL FAMILY INCOME						
86. To provide cleaner and better tasting drinking water.....	$.00	$.01	$.05	$.25	$1	$5	$25+
87. To provide better city transit.....	$.00	$.01	$.05	$.25	$1	$5	$25+
88 To provide better control of traffic in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
89. To provide horsebackriding paths in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
90. To provide bicycle paths in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
91. To provide snowmobile paths in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
92. To provide more restrictive downtown parking.....	$.00	$.01	$.05	$.25	$1	$5	$25+
93. To provide more parks and green areas in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
94. To provide better recreation facilities in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
95. To provide for more gardens in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
96. To provide for more beautification of towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
97. To provide for more shade in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
98. To provide for more landscaping in towns.....	$.00	$.01	$.05	$.25	$1	$5	$25+
99. To provide for public use of riverbanks and lakeshores.....	$.00	$.01	$.05	$.25	$1	$5	$25+

APPENDIX B

Detailed Statistical Information

The factor analysis of the ratings of all 99 items by the 50 subjects employed the PA 2 technique (see Kim, 1975). This technique uses:

1. pairwise deletion of missing variables,
2. principal factoring with iteration, and
3. varimax rotation.

Table 3 presents the eigenvalue for each factor. Eigenvalue expresses mathematically the relative importance of a factor. Eigenvalue is the total amount of variance in the ratings accounted for by a specific factor (Kim, 1975). Factorization can be further clarified by considering 100% to be the total variance accounted for; then the percentage (or cumulative percentage) of variance accounted for by the factors becomes a useful measure of the importance of each factor (or combination of factors).

Table 4 presents the correlation coefficients indicating the degree of relationship between a specific item and a factor. These correlation coefficients theoretically extend from -1.000 through 0.000 to +1.000. Table 4 presents only those items with at least a .361 correlation with a factor (regardless of sign), for this is the level at which the relationship is statistically significant beyond the .01 level. Items with positive correlations contribute directly to the factor, whereas those with negative correlations contribute inversely to the factor.

* * *

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